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EPA, REGION III
OFFICE OF REGIONAL COUNSEL

September 17, 1985

HAND CARRY

Judith Dorsey, Esquire (2RC20)
U.S. Environmental Protection Agency
Region III
841 Chestnut Bldg. (8th Floor)
Philadelphia, PA 19107

RE: Tybouts Corner Landfill

Dear Judy:

Enclosed please find:

1. the report of Duffield Associates relating primarily to the cap of the Main Landfill and excavation of the West Landfill;

2. the report of Lawler, Matusky and Skelly which relates primarily to the trenching; and

3. the report of Paul Roux Associates, Inc. relating primarily to groundwater remedial measures.

If you have any questions concerning this, please feel free to call.

Very truly yours,

Denis V. Brenan

/kmt

Enclosures

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WEST LANDFILL/MAIN LANDFILL SURFACE CAP

A. Summary Of Proposal

The west landfill would be excavated and the contents (here assumed to be the 63,000 cubic yards estimated in the RI/FS) would be placed on the main landfill as part of the overall regrading and surface cap installation at the main site. The excavation would, after such de-watering as may be necessary, be backfilled with clean silt material.

The design and effectiveness of the main landfill cap would closely approximate that of a RCRA landfill closure cap but primarily employ locally obtainable materials in a design that will minimize the O&M costs of a RCRA cap due to site specific conditions. Computer modelling results show that, on the basis of a conservative estimate of the reduced vertical infiltration resulting from this design, the proposed cap and lateral diversion system will be an effective means of source control. This would be accompanied by a system (designed to reflect this landfill's age) to allow the venting of residual methane gas from within the site.

B. Preliminary Design Parameters And Their Effectiveness

Excavation of the west landfill must be considered the optimal means of controlling the source of any groundwater contamination attributable to that portion of the site. Placement of these materials on the main landfill will, in comparison to other methods identified in the RI/FS, allow for their safe disposal at minimal cost without overland transportation of excavated waste or incinerator residue. This entire aspect of the project can be implemented on-site, using off-road equipment, thereby avoiding the logistical strain on local transportation systems and any perceived environmental hazards associated with any other means of disposal identified in the RI/FS. Use of material excavated from the west landfill will also assist in the overall regrading of the main landfill (which slope is necessary to maximize surface runoff) without the need to import additional materials from offsite.

The attached plan shows the preliminary design for regrading of the main landfill and for the surface cap that would be installed over the site. It must be emphasized at the outset that this design approximates that of a RCRA closure cap but takes account of an important factor that the RCRA cap designs in the RI/FS did not adequately consider, i.e., differential settlement. The closure cap design contemplated under the RCRA regulations is for the most part premised on a disposal site that was designed from the outset to minimize differential settlement.

This, of course, is not true of pre-RCRA sites that, like Tybouts Corner, were operated over 15 years ago as municipal waste disposal sites. An actual RCRA cap--with clay layers separated by gravel and fabric layers and intersected horizontally by a lateral gas venting system--will result in excessive O&M costs. In terms of its "impermeability," the extensive repair work on a RCRA cap (involving the repeated "stripping" of the various layers to maintain the integrity of the overall system) will have so great an impact on the long-term effectiveness of such a cap that the very substantial cost differential between a RCRA cap and the design here proposed cannot be justified in terms of any abstract differences in the permeability of the two designs. This is underscored by the fact that, in conjunction with the lateral diversion/leachate collection system also proposed, any residual precipitation that might percolate into the fill can have no more than a negligible impact on local groundwater conditions.

In short, while it may literally comply with RCRA, an actual RCRA cap is very poorly suited to site conditions, and the staggering differential in both capital and O&M costs associated with the RCRA design cannot be justified in terms of the at best negligible distinction in the effectiveness of the two designs.

This is more evident on review of the specific elements of the proposed design. First, the grading plan will result in an overall slope of approximately four percent. The slope will be a relatively steady one that will eliminate the localized ponding (and consequent accelerated percolation) resulting from the swales and depressions now randomly covering the site.

Immediately atop the existing surface of the landfill will be a two-foot layer of compacted silt material. Very large and homogenous stockpiles of such material (principally dredgespoil) exist within a short distance from the site and are obtainable at low cost. This compares with the clay that would be the principal material used in construction of a RCRA cap. As acknowledged in the RI/FS, no suitable supply of this material is presently available within Delaware itself. Locating and transporting a quantity of such material, sufficiently homogenous in its natural state to avoid the necessity of admixtures such as bentonite to insure uniform application, will add enormously to the costs of remediation.

That differential cannot be justified in view of the demonstrated effectiveness of this material. Silt materials, also consisting primarily of dredgespoil, were employed in a very similar liner design at the Cherry Island Landfill in nearby Wilmington, Delaware. This 40-acre site is underlain by silt material that was successfully compacted to a uniform permeability factor of 10^{-7} cm/sec. Given the similarity of material and construction methods, the same results should be obtainable at this site.1/ Additionally, experience at the

1/ Preliminary testing of potential sources of this material for (footnote continued)

Pigeon Point Landfill, where this same material was used in constructing a cap for a municipal landfill, has demonstrated that this materials' inherent flexibility is highly desirable in landfill applications where substantial settlement is anticipated. This minimizes the O&M costs associated with repairing more rigid clay caps that tend to split along seams as a result of settlement.

The remainder of the system, moreover, is designed to minimize the amount of percolating water that would even reach this base layer of the system. Immediately above and entirely covering the compacted silt will be a layer of Typar (No. 3353). This is a 16 mil coated geotextile fabric with a permeability of less than 10-7 cm/sec. This material would be placed lengthwise across the site, against the grain of the downslope, in ten-foot widths. The individual lengths would be overlapped two feet to produce much the same effect achieved by the overlapping shingles on the sloped roof of a building, i.e., water that penetrated to the Typar membrane would, by natural effects, be forced sideways down the overall slope rather than pool and tend to be drawn downward into the compacted layer of silt. This overlapping also will make the entire installation more flexible in relation to the differential settlement that will take place at this site,

(footnote continued from previous page)
E-P toxicity and PCB levels did not indicate any source of contamination. Additional sampling will be conducted in potential borrow sources for the full range of priority pollutants and to establish compaction and permeability parameters prior to application on the site.

i.e., in addition to the stretch of any individual length of Typar, the overlap will build in an additional safety margin against breaching the integrity of the membrane due to the forces of settlement.

Above the Typar will be an 18-inch layer of sandy silt material topped with a 6 inch layer of topsoil. This will serve as a buffer/growing zone between the roots of surface vegetation and the Typar and compacted silt layers. It will also promote the downslope and offsite drainage of any precipitation that is not carried off by the final, vegetated topsoil layer and evapotranspiration.

The gas venting system is similarly designed to meet RCRA goals in a manner acknowledging site-specific conditions. As reflected in the attached report prepared after recent inspection and testing at the site by Wehran Engineering, it is evident that this landfill has passed the point of maximum gas generation for which a RCRA-type system is designed. Vents on the 200-foot grid reflected in the accompanying site plan represent a system that will permit the positive venting of remaining cases being generated. This vertical point system will also be relatively unaffected by settlement. The vertical point system will not experience the type of horizontal buckling to which the other system will be subjected due to settlement, thereby eliminating the considerable O&M costs and reduced design effectiveness associated with the continual repair of localized damage to a venting system extending horizontally beneath the site.

To summarize, no cap system can realistically be considered to be permanently and totally impervious to surface water due to the nature of the materials employed. The RCRA cap design may be said to employ relatively impervious materials, but a site specific condition--differential settlement--will of necessity here result in some continued percolation of surface water through the cap. The system here proposed is designed fully to meet that factor, in terms of its individual components and an overall design that will both minimize and expedite any maintenance necessary to preserve the integrity of the system. At the same time, the proposed system itself is designed to reduce infiltration to the same degree as a RCRA cap, and, as discussed above, computer modelling results have shown that, in conjunction with the lateral diversion system, the reduced infiltration conservatively resulting from this cap design will produce an effective means of source control.

16 September 1985
File No. 464-001

REMEDIATION PLAN - SUBSURFACE DRAINS

The draft RIFS for the Tybouts Corner Landfill included several alternative remedial actions. Prior to publication of the draft the generators recommended a remedial plan including a subsurface drain arrangement involving two drains, one along the eastern (Route 13) boundary of the landfill and a second from Route 13 to Route 71 along the southern (or southwestern) side of the landfill to lower the water table in the refuse and to collect leachate. Principally, because of a difference in interpretation of the data involving (1) the occurrence of the Merchantville Formation and (2) the elevation of the water table prior to gravel mining operations, EPA, DNREC, and NUS argued that the southern drain would not capture leachate because of the perching influence of the confining bed underlying the refuse. In the spirit of cooperation and sharing a mutual desire to agree upon a cost effective plan to remediate the landfill, we have reexamined the data and considered the objections of all parties to the original plans. Where no data refute the NUS interpretation, we have accepted it and input the NUS data in the groundwater model to evaluate several different subsurface drain arrangements. In addition, we have had on-going discussions with NUS in an attempt to arrive at a mutually agreeable remedial scheme that accomplished the stated objectives, which are:

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1. To eliminate or appreciably reduce infiltration

2. To eliminate or control lateral migration of groundwater into the landfill.

3. To eliminate or control the contaminated groundwater that might eminate from the landfill, and

4. To eliminate or control the present surface discharge of leachate to the environment.

The remedial technologies incorporated in the revised remedial alternative are all described in the draft RIFS. The recommended alternative would include:

1. Installation of a low permeability cap with a synthetic liner and surface runoff control.

2. Construction of an upgradient interceptor subsurface drain.

3. Construction of a downgradient contaminated groundwater control subsurface drain.

4. Collection and disposal of contaminated groundwater stored in the refuse.

The design and construction of the low permeability cap (Item 1) is described separately. While the synthatic liner is practically impemeable, our model input assumed leakage through the cap of 7% of the 12.5 in. per year of existing infiltration. This averages about 3000 gpd. Items 2 and 3 are described in detail in the following paragraphs. Item 4 is presently under discussion by others with Wilmington Suburban Sewer District and Texaco Oil Company.

As mentioned above, we have obtained the input data file for the NUS model and have used it in our model tests to optimize the design of a subsurface drainage system. Initially, the model was used to simulate the existing water table as a check on its reliability. This being accomplished, the model was used to simulate water-table elevations and flows for a number of subsurface drain configurations. The model output data were used to contour the water table after remediation when steady state conditions have been achieved. These contours were used to determine directions of lateral groundwater movement and to estimate flow from the drains and rates of groundwater movement. After arriving at the optimal alternative under steady state conditions, the drain configuration was tested for a number of time dependent stress periods. The tests indicate that the system described below will accomplish the desired remediation.

The upgradient subsurface drain extends from Route 13 in a straight line along the northern boundary of the landfill in a generally westward direction to Route 71, where the ditch turns southward for a short distance along the western boundary of the landfill (see Figure 1). The total length of the drain is 1,400 feet, and its depth ranges from 27 to 33 feet. These depths are coincident with the top of the confining layer under the landfill, based on NUS data. The drain will be constructed by excavating a trench to the required depth and laying in the bottom a 6-inch diameter perforated PVC collector pipe. This pipe will be surrounded by gravel, which will be extended upward to the level of the existing water table. The gravel will be covered with a geotextile fabric and the ditch backfilled with soil to land surface. A typical section is enclosed as Figure 2. The surface grading will be extended to divert all site surface discharge to the surface drainage ditch where it will be diverted to Pigeon Run. The pipe and the drain will be pitched to the southeast to a collector sump, where the water will be pumped to a disposal facility. In time, it is expected that this drain will yield water that could be diverted to Pigeon Run.

The purpose of the upgradient subsurface drain is to intercept groundwater flow onto the landfill from the north, northeast, and northwest. The model simulation indicates that this revised drain effectively intercepts the water flowing through the Columbia Formation that would otherwise flow into the refuse. The drain follows a straight line across the north end of the landfill, which leaves a small portion of waste on the upgradient side of the drain. However, the drain will lower water levels on the upgradient (north) side as well as the downgradient (landfill) side, and the simulation indicates that the waste will be essentially dewatered. Although unlikely, if a small amount of contaminated groundwater is generated in this area, it would migrate directly into the drain, where it would be captured.

The downgradient drain is designed to collect contaminated groundwater from both the Columbia Formation and the upper Potomac Formation. This drain will lower groundwater levels in its vicinity and will eliminate the seep that occurs along the east side of Route 13 north of Red Lion Creek. The downgradient drain is about 1,6C0 ft long and follows the perimeter of the southernmost tongue of refuse in the main landfill (see Figure 1). One leg of the drain runs generally southward in the drainage gully located on the west side of the access road. Opposite the toe of the waste, the drain turns eastward in a straight line to the edge of the property near well TY-205. At this point, the drain turns northward a short distance along the Route 13 property boundary. The depth of the collector will range from 10 to 20 ft below grade and will average 15 feet. The northern extremities will collect flow from the Columbia Formation and the southern portion of the drain will collect water from the upper part of the Potomac Formation. Design of the drain will be the same as the deeper 15 ft segment of the north drain. A typical section is shown on Figure 2.

The drain along the north side of the site could be constructed in two stages: a shallow open ditch about 15 ft deep with a steep-walled box trench within it for the lower 15 ft. A construction easement would be needed for the construction of the open ditch, as the excavation would encroach on state property. However, the completed drain system could be contained on site. Manholes are proposed at 300-400 ft spacing to monitor and regulate flow and to remove sediment if its accumulation interferes with system performance. Residual excavated soil will be used to achieve the requisite surface grade on the landfill and to construct surface water diversion courses. The segments of the north drain at its western end may require sheet piling (with salvage of the piles) through the refuse and along Route 71. Drain depths in this area average 30 ft. The construction will be phased so that the waste sump and disposal line for each drain are constructed first. Waste water generated during construction will be monitored for quality and discharged via the waste lines.

The results of the computer model indicate that after a period of about 3 years, the water table in the refuse will have been lowered to the extent that the refuse is essentially dewatered. Figure 1 shows the water table configuration simulated by the model after remediation, and Figure 3 indicates the amount of water-level depression accomplished by the remediation. Using the model predictions, we estimate that only about 6% of the refuse will remain saturated under the scheme, a large part of which is in the depression surrounding well TY-311. It should be noted that because of this depression in the confining bed, no system of subsurface drains will accomplish 100% dewatering of the refuse. However, recharge to this depressed area will be drastically reduced, if not eliminated, by the proposed remediation scheme, and little contaminated groundwater should be generated once this system has drained the refuse.

Wet sumps will be installed at the eastern end at each drain. The sumps will each have a backup pump. The north drain sump will be designed for 100 gpm pending final design data while the south drain is expected to handle a maximum of 50 gpm. A 4 in diameter discharge line from the north drain will extend to the south drain sump

Run. One line from the south sump will go to the stream and a second to either the Texaco facility or the Wilmington sewer connection. Either is about 2 miles from the landfill.

The computer modelling indicates that maximum water level drawdown will be reached about 3 years after the onset of operation. The combined flows to the two drains at that time are estimated at 15 gpm. Initial flows will be somewhat higher (80 gpm), but the flows from both systems can be staged intentionally, thereby reducing the initial volumes significantly. The construction will be phased so that the waste sump and disposal line for each drain are constructed first. Waste water generated during construction will be monitored for quality and discharged via the waste lines.

Interpretation of the simulated water-table map (Figure 1) indicates a small amount of flow onto the landfill after remediation. However, the flow from the northwest will be chiefly beneath the refuse in Columbia sand. Some of this water will discharge vertically to the Potomac Formation and the remainder will be captured by the Route 71 trench. The total flow onto the landfill along Route 71 is estimated at 1,440 gallons per day, which is equivalent to 1 gpm. Some flow will also occur from the Route 13 side of the landfill, draining parts of the Wagner and Texaco properties. The estimate of this flow is 1,300 gpd (1 gpm), which is also insignificant compared to the total flow of 11,500 gpd (8 gpm) that will be intercepted by the northern drain.

This plan has been discussed with NUS during its development and has been tested by NUS on their model. It is our considered opinion that this plan accomplishes the desired remediation in a cost effective manner. In addition, the downgradient drain has the further advantage of collecting contaminated groundwater, which the upgradient interceptor drains described in the RIFS did not do.

In summary, the proposed cap and subsurface drain system described above will adequately satisfy all of EPA's objectives for remediation of Tybouts Corner Landfill.

- The low permeability cap will appreciably reduce infiltration to less than 7% of the present infiltration.

- A estimated 80 to 90% of actual migration of groundwater into the landfill will be collected by the north drain.

- Contaminated groundwater will be largely eliminated by source control as a result of capping and the upgradient (north) drain; residual contaminated groundwater will be collected by the downgradient (south) drain.

- Present surface discharges (seeps) to the environment will be eliminated since the cap and drains will lower the water in the landfill and the water will now flow to the south drain.

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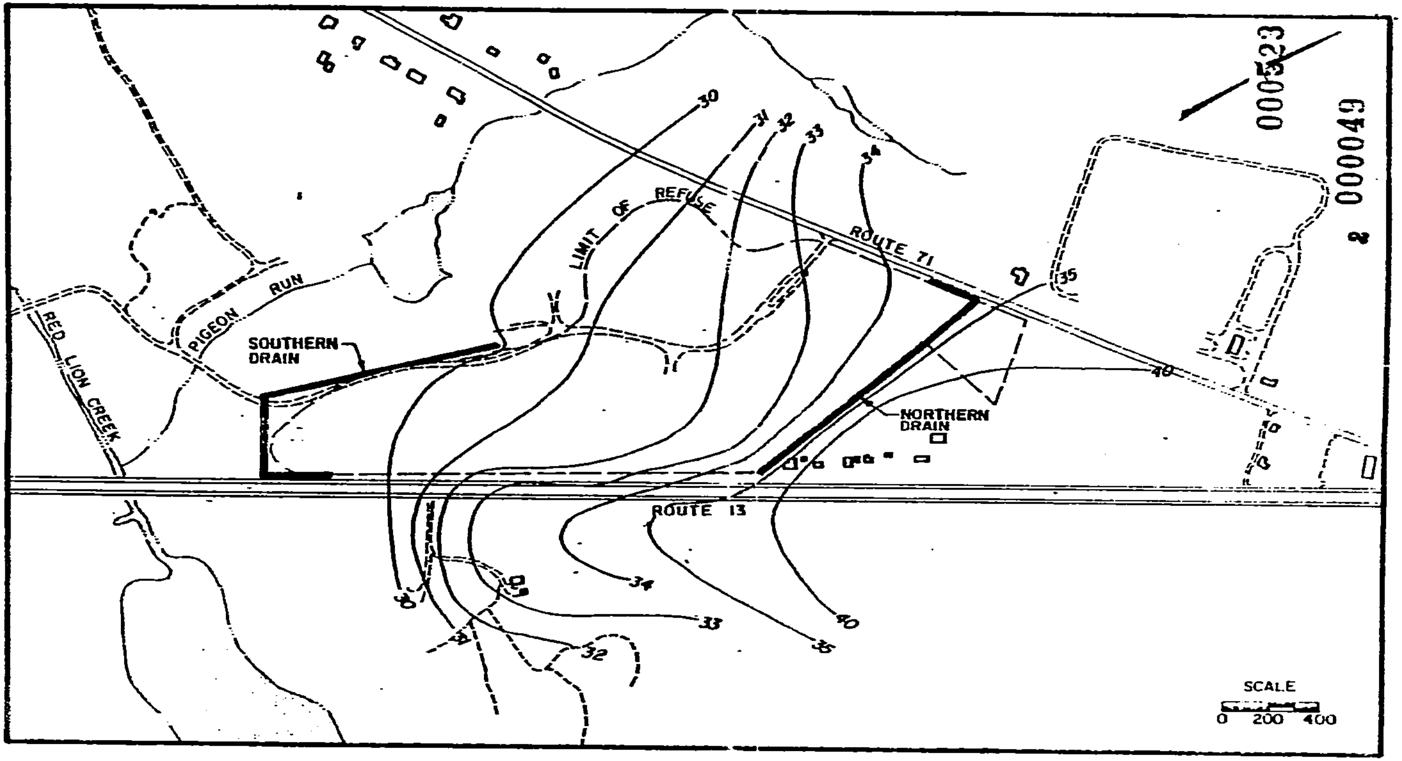

FIGURE 1

SIMULATED WATER TABLE CONTOURS AT STEADY STATE CONDITION
(approximately three years)

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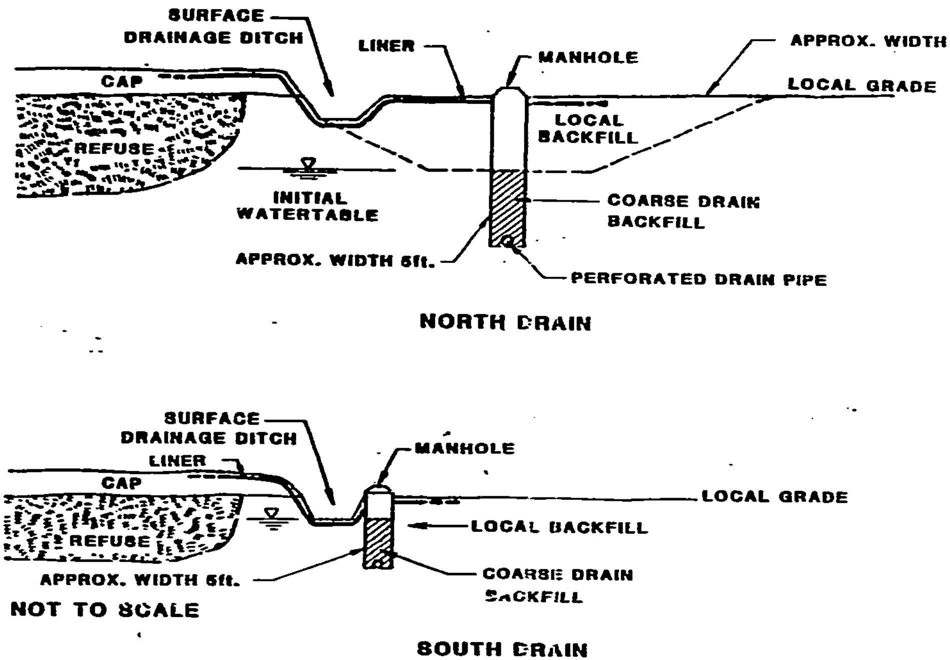

FIGURE 2

TYPICAL DRAIN SECTION

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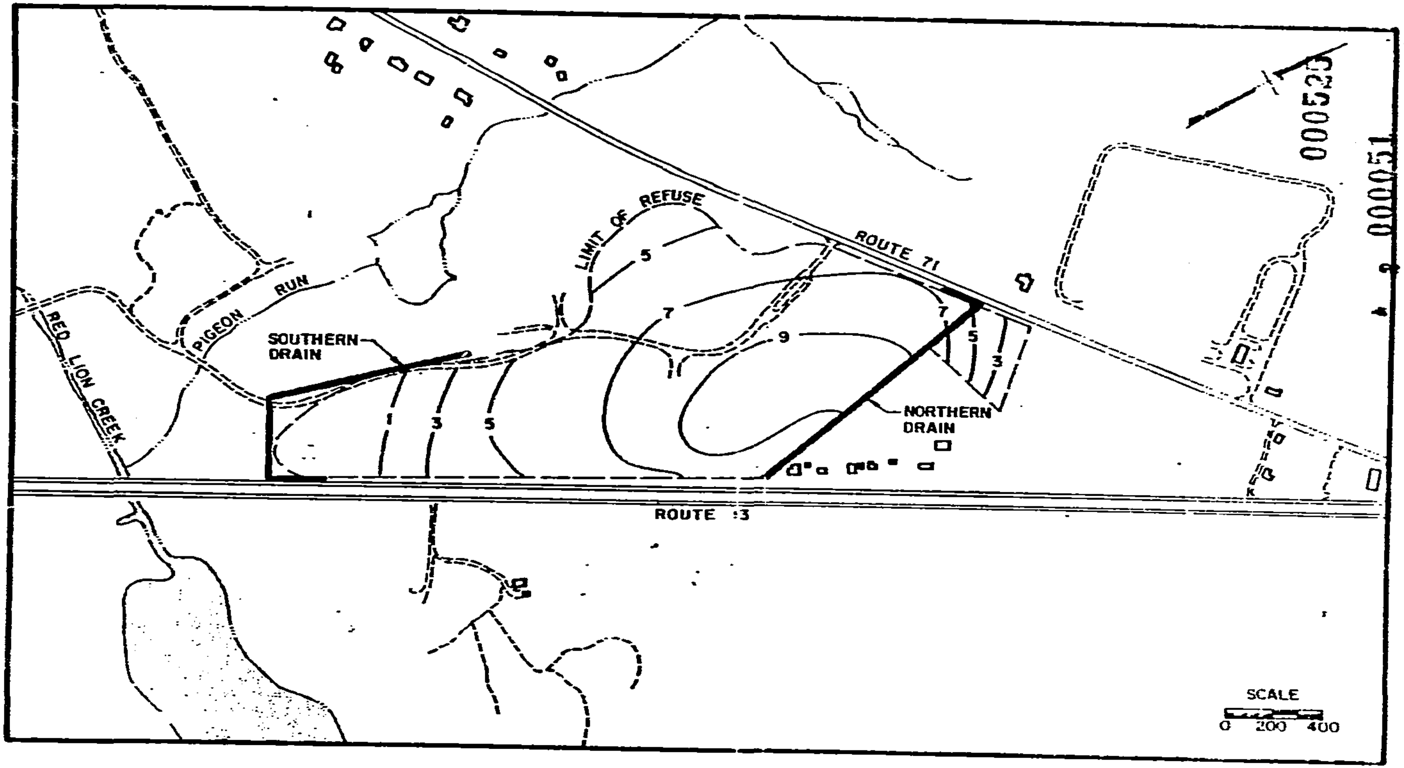

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FIGURE 3

SIMULATED DECLINE IN WATER TABLE AT STEADY STATE CONDITION (approximately three years)

TYBOUTS CORNER LANDFILL

GROUND-WATER REMEDIAL MEASURES

OFF-SITE MONITORING PROGRAM

The NUS study has revealed organic compounds in ground water beyond the boundaries of the landfill in several wells tapping the Columbia aquifer and the underlying No. 1 Sand. The locations of these wells and the general direction of ground-water flow in the Columbia and No. 1 Sand are shown on attached Figure 1.

1. In view of the rate and direction of ground-water flow in the Columbia reported by NUS, it is likely that the contamination from the Columbia aquifer has been discharging into Red Lion Creek for a number of years. There is also some visible seepage of contamination to Red Lion Creek. The water and sediments in the creek have been sampled by NUS and no adverse impact on the creek is detectable. Accordingly, no remedy is warranted for the Columbia aquifer.

2. All of the impacted wells in the No. 1 Sand are within 500 feet of the landfill. Since the base of the landfill is in direct contact with ground water in the No. 1 Sand, contaminants would have entered this aquifer at the time the landfill opened. Therefore, the NUS data indicates that the contaminant plume in the No. 1 Sand has moved only about 500 feet in the 15-year period since the establishment of the landfill.

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In view of the direction of ground-water flow in the No. 1 Sand, it is likely that Red Lion Creek would be the discharge area for contaminants in this unit. However, ground-water flow in the No. 1 Sand is very slow (30-60 feet per year, based on NUS measurements). Movement of contaminants in the No. 1 Sand is so slow that it will probably take another 15-30 years (based on the distance travelled to date as measured by NUS) for these contaminants to reach the creek, at which time they may discharge into the creek without detection. The slow rate of ground-water movement, the limited extent and relatively low levels of contamination, the relatively large flow of water in the creek and the natural attenuation of contaminants on aquifer sediments make it highly unlikely that contaminants will ever have an adverse impact on the creek. The conclusion which we reach based on the above facts is that there is insufficient data to justify implementation of any remedial action with respect to the No. 1 Sand.

3. Contaminants were found in the No. 2 Sand (which underlies the No. 1 Sand) only in one well and at very low concentrations. Other wells in the No. 2 Sand surrounding the landfill are not contaminated. There appears to be a continuous clay layer between the No. 1 and No. 2 Sands, although NUS believes that there may be areas of interconnection based on pumping test results. We believe that there is insufficient data to reach a conclusion on the level of contamination in the No. 2 Sand and whether

remedial action is necessary. The appropriate measure, therefore, is to monitor the No. 2 Sand as outlined later in this proposal, and if data establishes contamination, identify appropriate remedial responses, if any, at that time.

4. In summary, the results of the RI/FS do not adequately support the selection at the present time of any long-term, direct groundwater remediation alternative. As recognized in the RI/FS itself, extensive additional field testing and design investigation would be required prior to implementing either of the "pump and treat" alternatives discussed therein. Given both the limited data and the need in any case for further testing prior to design, EPA should not at this stage select any option for groundwater remediation. Instead, it should adopt the monitoring program detailed below which would 1) monitor plume movement; 2) monitor the No. 2 sand; 3) monitor the impact of the start-up of Well OR-6A; and 4) monitor the effectiveness of Well OR-6A as an intercept system, if it is needed. (Part 1 of the plan addresses the first three objectives; Part 2 is designed to monitor the effectiveness of OR-6A as an intercept system if that system is needed).

This approach would serve two principal purposes. First, it would permit Texaco to begin production from its idle well OR-6A and thus make use of this aquifer rather than bring about the total restriction on access that would result from immediate implementation of any "pump and treat" options. Second, it would provide the data, which is concededly lacking at this stage, necessary to gague the long-term necessity for and effectiveness of any system of groundwater remediation.

Implementation: Part 1

The proposed monitoring program uses six existing well clusters (in the TY series) and requires the installation of one new well cluster. The locations of the seven proposed monitoring well clusters (with wells screened in the No. 1 Sand and No. 2 Sand) are shown in Figure 2. The new well cluster should be designated TY-122. The following wells should be monitored:

TY-116A	TY-119A
TY-116B	TY-119B
TY-116C	TY-120A
TY-117B	TY-120B
TY-118A	TY-121B
TY-118B	TY-122A
	TY-122B

These wells should be sampled twice a year for the following constituents:

bis (2-chloroethyl) ether
1,2 - dichloroethane
1,1 - dichloroethane
methylene chloride
chloroethane
toluene
benzene
tetrachloroethylene
trichloroethylene
specific conductivity

These constituents were selected because (1) they have been found by NUS in high concentrations under the landfill; (2) they have been found in wells adjacent to the landfill (off-site); and (3) they are relatively mobile in an aquifer. If any of these compounds are detected and confirmed, a full priority pollutant scan would be run on a sample from that well [illegible]

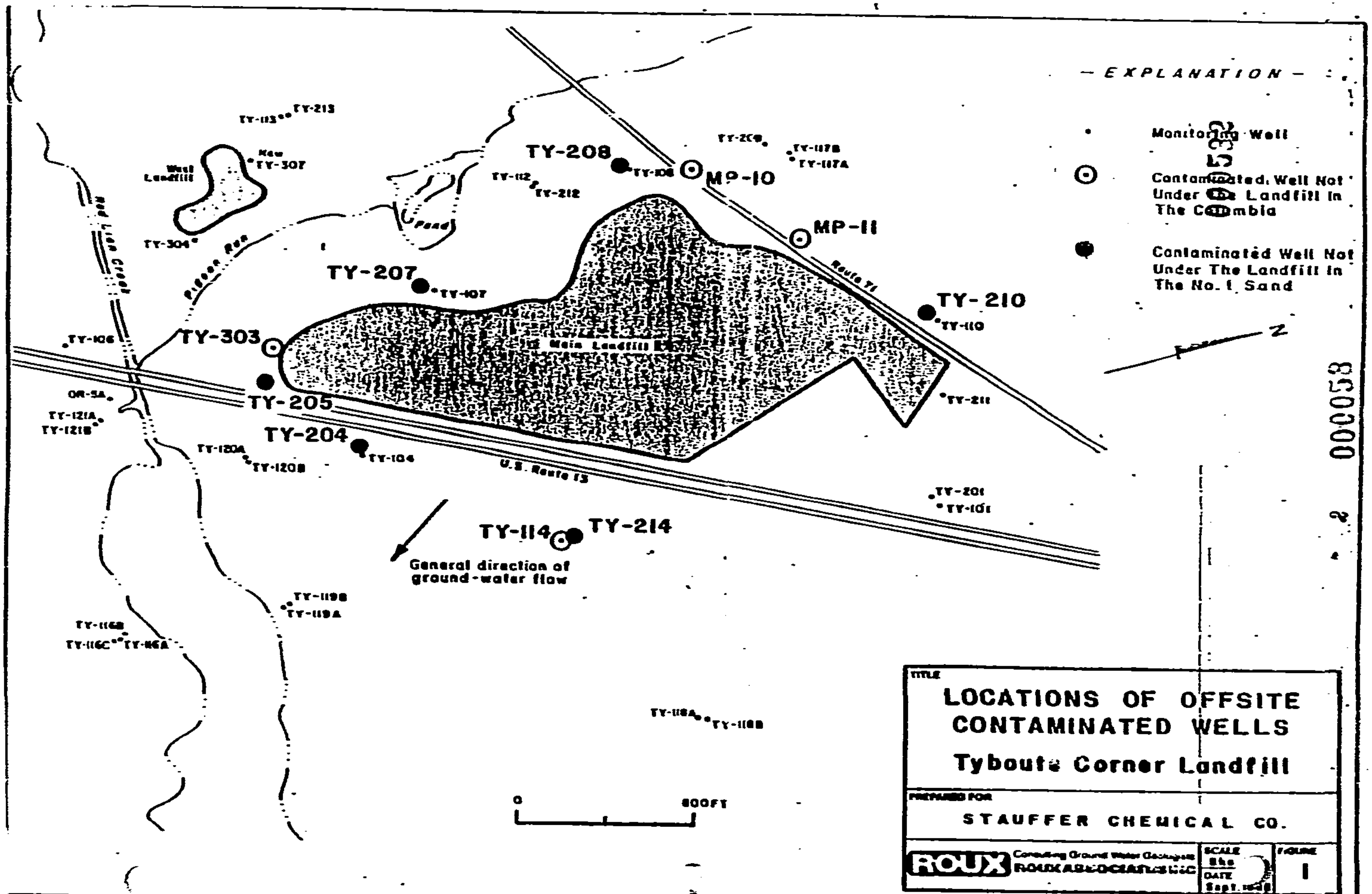
If contaminants are detected in wells on the north side of Red Lion Creek but not on the south side, the Creek should be monitored at three locations (upstream, adjacent to the landfill and downstream) at the same times the well are sampled and for the same constituents.

Part II. If contaminants are detected south of Red Lion Creek, then OR-6A may be used as an intercept system. This segment of the monitoring plan should be implemented to determine the effectiveness of OR-6A as an intercept system.

Four new monitoring well clusters (labelled MW1, MW2, MW3 and MW4) are proposed at the locations shown on attached Figure 3. These locations were chosen because if contaminants were to pass under the Creek and beyond OR-6A, they would move toward either the Delaware River to the east or Texaco pumping wells to the south. The proposed locations would monitor all southeasterly ground-water flow from the landfill and all southerly and easterly ground-water flow from the vicinity of OR-6A. Any contamination moving under Red Lion Creek from Tybouts Corner Landfill should be detected by one or more of these wells.

Each well cluster would consist of two individual wells, one screened at the geologic horizon identified as the No. 1 Sand and the other screened at the horizon 000530 identified as No. 2 Sand. That is, screen elevations would be comparable to the elevations of screens in the TY series, although they would be adjusted as necessary to fit local geologic conditions.

The new monitoring wells, if they prove to be necessary, would be 4-inch diameter, PVC wells with 20-foot long screens. The construction and development would be the same as the TY-Series. The new monitoring wells would be purged and sampled in the same manner as the TY-Series. Constituents analyzed would be those detected south of Red Lion Creek or in the TY-Series wells directly north of the Creek. The wells would be sampled quarterly in lieu of the TY-Series wells.



TITLE

LOCATIONS OF OFFSITE CONTAMINATED WELLS

Tyboute Corner Landfill

PREPARED FOR

STAUFFER CHEMICAL CO.

ROUX Consulting Ground Water Geologists

SCALE	FIGURE
DATE Sept.	1

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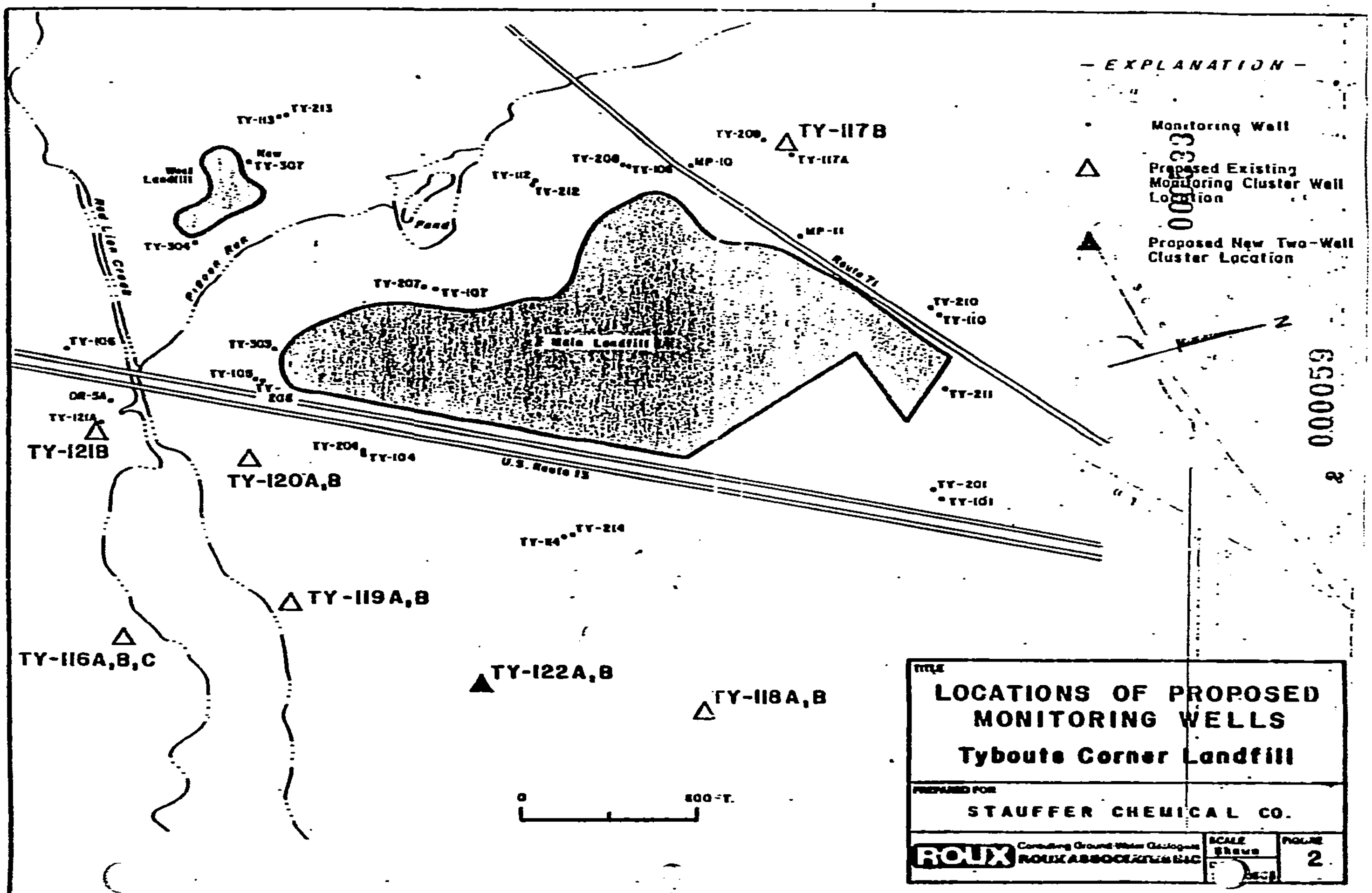


TITLE

LOCATIONS OF PROPOSED MONITORING WELLS

Tyboute Corner Landfill

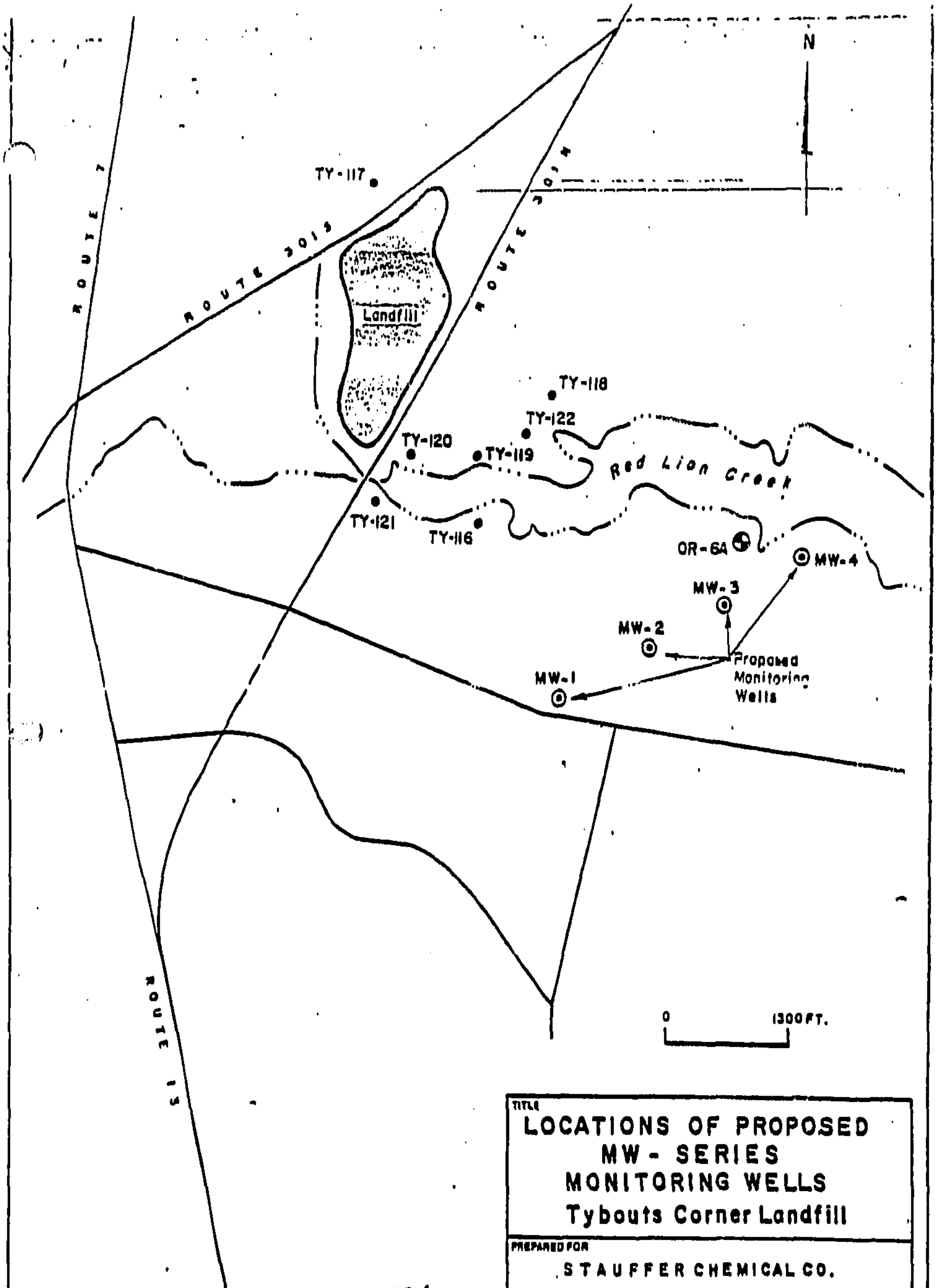
PREPARED FOR

STAUFFER CHEMICAL CO.

ROUX Consulting Ground-Water Geologists ROUX ASSOCIATES INC

SCALE Shown

FIGURE 2



TITLE

LOCATIONS OF PROPOSED MW - SERIES MONITORING WELLS

Tybouts Corner Landfill

PREPARED FOR

STAUFFER CHEMICAL CO.

ROUX Consulting Ground-Water Geologists ROUX ASSOCIATES INC

SCALE Shown | DATE Sept. 1985 | FIGURE 3

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